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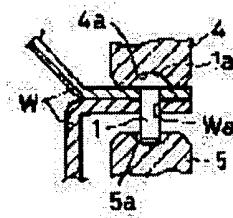
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(54) RIVET FASTENING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To enable caulking with low load by pinching and pressing a rivet inserted through a plurality of work pieces between a pair of electrodes, by softening the rivet by resistance generated heat of the rivet itself by electrification, and by caulking the end.

SOLUTION: A headed rivet 1 is inserted through holes Wa of two work pieces W so that the head part 1a on the upper end may be seated on the work piece W on the upper side, the rivet 1 is pinched between electrodes 4, 5 of a welding gun and pressed, and the rivet is electrified. The tips of the electrodes 4, 5 are formed into recessed curved surfaces 4a, 5a, the head part 1a is brought in surface-contact with the curved surface 4a, and the lower end of the rivet 1 is brought in linear-contact with the curved surface 5a. Accordingly, the current density of the lower end of the rivet 1 is drastically increased in comparison with the head part 1a and instantaneously heated to the high temperature. Therefore, the lower end of the rivet 1 is softened and caulked by low pressing force.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the riveting approach which combines two or more work pieces using a rivet.

[0002]

[Description of the Prior Art] A riveting performs the edge of a rivet by caulking ****, after inserting a rivet in the hole formed in the work piece. And caulking of the rivet in works is conventionally performed using the press machine (refer to JP,1-241346,A).

[0003]

[Problem(s) to be Solved by the Invention] Like the above-mentioned conventional example, in the thing using a press machine, the noise and an oscillation become a problem and it is become easy to produce deformation of curvature, distortion, etc. according to the caulking force to a work piece that work pieces are elasticity material, such as sheet metal and aluminum.

[0004] This invention makes it the technical problem to offer the riveting approach which might have caulking of a rivet be made to be performed by the low load, without using a press machine in view of the above point.

[0005]

[Means for Solving the Problem] That the above-mentioned technical problem should be solved, this invention is the riveting approach which combines two or more work pieces using a rivet, is energized in the condition of having pressurized inter-electrode [one pair of] on both sides of the rivet inserted in two or more work pieces, softens a rivet in resistance generation of heat of the rivet by energization itself, and the edge of a rivet is characterized into ***** and it is characterized by things.

[0006] According to this invention, with the Joule's heat by energization, a rivet carries out self-generation of heat, and becomes soft, and caulking ***** can do a rivet by the low load. Therefore, even if work pieces are elasticity material, such as sheet metal and aluminum, deformation of curvature, distortion, etc. is not produced to a work piece, and the noise and the problem of an oscillation can also be solved. Moreover, since a caulking load is reduced, caulking of a rivet can also be performed using the usual spot welder which has one pair of electrodes, a special facility becomes unnecessary, and it is advantageous also in cost.

[0007] In addition, even if a rivet is the thing of a pin configuration without the head, it may be a thing with the head which has a head at the end. For both ends, with the former rivet, a head and the other end of an opposite hand are caulking **** at the rivet of caulking ** and the latter.

[0008] Moreover, if the thing in which the head was formed on the reentrant curved surface is used as each electrode, line contact is carried out to a reentrant curved surface, the edge of a rivet comes to generate heat with sufficient responsibility by the increment in the current density by reduction in a touch area, and the edge of a caulking ***** rivet is advantageous.

[0009]

[Embodiment of the Invention] Drawing 1 shows the situation of the riveting activity which combines the work pieces W and W of two upper and lower sides with two or more rivets 1, moves a mounting beam and the spot welding gun 3 at the head of the robot arm 2 in order in the attaching position of each rivet 1, and is made to perform caulking of each rivet 1.

[0010] The detail is as being shown in drawing 2 , and first, as shown in drawing 2 (A), the rivet 1 with the head is inserted in the hole Wa formed in the work pieces W and W of two sheets so that head 1a of the upper bed may sit down to the upper work piece W. Next, as actuation of that application-of-pressure cylinder 3a shows a welding gun 3 to closing and drawing 2 (B), on both sides of a rivet 1, this is pressurized from the upper and lower sides between the electrode 4 of one pair of upper and lower sides of a welding gun 3, and 5, and it energizes on a rivet 1 in this condition.

[0011] Here, although the head of each up-and-down electrodes 4 and 5 is formed in the reentrant curved surfaces 4a and 5a and head 1a of a rivet 1 carries out field contact at reentrant curved-surface 4a of the top electrode 4, line contact of the soffit of a rivet 1 is carried out to reentrant curved-surface 5a of the bottom electrode 4. Therefore, the current density of the soffit of a rivet 1 compares with the current density of head 1a, it increases substantially, and the soffit of a rivet 1 generates heat to an elevated temperature by energization in an instant. And as the soffit of a rivet 1 softens by this generation of heat and welding pressure shows to drawing 2 (C), the soffits of a rivet 1 are caulking ***.

[0012] In addition, with the above-mentioned operation gestalt, although the rivet 1 was made into the thing with the head, the thing of a pin configuration without the head as shown in drawing 3 can also be used. In this case, as insert a rivet 1 in the hole Wa of work pieces W and W by the light pressure close as shown in drawing 3 (A), and it is made not omitted [a rivet 1], next it is shown in drawing 3 (B), it energizes in the condition of having pressurized on both sides of the rivet 1 between one pair of electrodes 4, and 5. In this case, they are caulking ****, as the ends of a rivet 1 generate heat and soften to an elevated temperature in an instant and the ends of a rivet 1 show drawing 3 (C) with welding pressure, in order that the ends of a rivet 1 may carry out line contact to the reentrant curved surfaces 4a and 5a of each electrodes 4 and 5, respectively. In addition, although a rivet 1 is a pin configuration in the air with this operation gestalt, it is easy to be natural even if it is the pin configuration of a solid.

[0013] When the riveting of the two aluminum containing alloy plates (A5182-0) with a thickness of 2.0mm was carried out using the rivet made from the aluminum containing alloy of the outer diameter of 8.0mm, the bore of 4.5mm, and a hollow pin configuration with a die length of 12mm (A5052), although the load required for caulking of a rivet was 2000kgf when not energizing, it was set to 300kgf(s) by energization of 20kA and 10 cycle (one cycle = 1/50Hz).

[0014] Moreover, when the riveting of the Zn steel plate with a thickness of 2.3mm of two sheets was carried out using the steel (S35C) rivet with an outer diameter [of 6.0mm], and a die length of 12mm, although the load required for caulking of a rivet was 3000kgf when not energizing, it was set to 300kgf(s) by energization of 9kA and 10 cycle.

[0015] Moreover, since the rivet made from aluminum had small electric resistance, the current value needed to be made high, but since heat conduction and heat divergence were good, it was also checked that compare when using a steel rivet, and the thermal effect to a work piece decreases.

[0016] In addition, although the spot welding gun 3 was used as caulking equipment with the above-mentioned operation gestalt, the spot welder of a stationary type may be used.

[Translation done.]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM MEANS
DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

Claim(s)]

Claim 1] The riveting approach which it is the riveting approach which combines two or more work pieces using a
rivet, and energizes in the condition of having pressurized inter-electrode [one pair of] on both sides of the rivet
inserted in two or more work pieces, is made to soften a rivet in resistance generation of heat of the rivet by
energization itself, characterizes the edge of a rivet ***** and is characterized by things.

Claim 2] The riveting approach according to claim 1 characterized for the both ends of a rivet by caulking *****
ing the thing of the pin configuration without the head as a rivet.

Claim 3] The riveting approach according to claim 1 characterized for the other end of a rivet by caulking *****
ing the thing with the head which has a head at the end as a rivet.

Claim 4] The riveting approach given in claim 1 characterized by using the thing in which the tip was formed on the
entrant curved surface, as said each electrode thru/or any 1 term of 3.

Claim 5] Said one pair of electrodes are the riveting approaches given in claim 1 characterized by being the electrode
attached in the spot welder thru/or any 1 term of 4.

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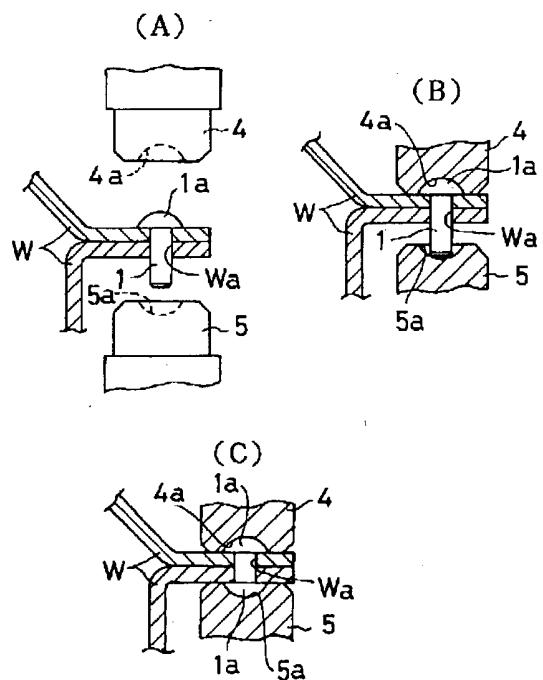
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(54)【発明の名称】 リベット締め方法

(57)【要約】

【課題】 リベットを低荷重で加締められるようにする。

【解決手段】 リベット1を1対の電極4, 5間に挟み、リベット1を加圧した状態で通電する。そして、通電によるリベット自体の抵抗発熱でリベットを軟化させ、リベットの端部を加締める。電極4, 5の先端を凹入曲面4a, 5aに形成し、リベット1の加締め端を電極4, 5に線接触させて電流密度を大きくし、加締め端が応答性良く発熱して軟化されるようにする。



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【特許請求の範囲】

【請求項1】複数のワークをリベットを用いて結合するリベット締め方法であって、複数のワークに挿通したリベットを1対の電極間に挟んで加圧した状態で通電し、通電によるリベット自体の抵抗発熱でリベットを軟化させて、リベットの端部を加締めることを特徴とするリベット締め方法。

【請求項2】リベットとして頭無しのピン形状のものを用い、リベットの両端部を加締めることを特徴とする請求項1に記載のリベット締め方法。

【請求項3】リベットとして一端に頭部を有する頭付きのものを用い、リベットの他端部を加締めることを特徴とする請求項1に記載のリベット締め方法。

【請求項4】前記各電極として、先端を凹入曲面に形成したものを用いることを特徴とする請求項1乃至3の何れか1項に記載のリベット締め方法。

【請求項5】前記1対の電極はスポット溶接機に取付けた電極であることを特徴とする請求項1乃至4の何れか1項に記載のリベット締め方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、複数のワークをリベットを用いて結合するリベット締め方法に関する。

【0002】

【従来の技術】リベット締めは、ワークに形成した穴にリベットを挿通した後、リベットの端部を加締めることで行なう。そして、工場におけるリベットの加締めは、従来、プレス機械を用いて行なっている（特開平1-241346号公報参照）。

【0003】

【発明が解決しようとする課題】上記従来例のようにプレス機械を用いるものでは、騒音や振動が問題になり、また、ワークが薄板やアルミ等の軟質材であると、ワークに加締め力によって反りや歪等の変形を生じ易くなる。

【0004】本発明は、以上の点に鑑み、プレス機械を用いずに低荷重でリベットの加締めを行ない得られるようにしたリベット締め方法を提供することを課題としている。

【0005】

【課題を解決するための手段】上記課題を解決すべく、本発明は、複数のワークをリベットを用いて結合するリベット締め方法であって、複数のワークに挿通したリベットを1対の電極間に挟んで加圧した状態で通電し、通電によるリベット自体の抵抗発熱でリベットを軟化させて、リベットの端部を加締めることを特徴とする。

【0006】本発明によれば、通電によるジュール熱でリベットが自己発熱して軟化し、低荷重でリベットを加締めることができる。そのため、ワークが薄板やアルミ

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等の軟質材であっても、ワークに反りや歪等の変形を生じず、また、騒音や振動の問題も解消できる。また、加締め荷重が低減されるため、1対の電極を有する通常のスポット溶接機を用いてリベットの加締めを行なうこともでき、特別な設備が不要になってコスト的にも有利である。

【0007】尚、リベットは、頭無しのピン形状のものであっても、一端に頭部を有する頭付きのものであっても良い。前者のリベットでは両端部が加締められ、後者のリベットでは頭部と反対側の他端部が加締められる。

【0008】また、各電極として、先端を凹入曲面に形成したものを用いると、加締めるべきリベットの端部が凹入曲面に線接触し、接触面積の減少による電流密度の増加でリベットの端部が応答性良く発熱するようになり、有利である。

【0009】

【発明の実施の形態】図1は、上下2枚のワークW、Wを複数のリベット1により結合するリベット締め作業の状況を示しており、ロボットアーム2の先端に取付け

20 た、スポット溶接ガン3を各リベット1の取付位置に順に移動して、各リベット1の加締めを行うようにしている。

【0010】その詳細は図2に示す通りであり、先ず、図2（A）に示す如く、2枚のワークW、Wに形成した穴Waに頭付きのリベット1をその上端の頭部1aが上側のワークWに着座するように挿通し、次に、溶接ガン3をその加圧シリンダ3aの作動で閉じ、図2（B）に示す如く、溶接ガン3の上下1対の電極4、5間にリベット1を挟んでこれを上下から加圧し、この状態でリベット1に通電する。

【0011】ここで、上下の各電極4、5の先端は凹入曲面4a、5aに形成されており、リベット1の頭部1aは上電極4の凹入曲面4aに面接触するが、リベット1の下端は下電極5の凹入曲面5aに線接触する。そのため、リベット1の下端の電流密度が頭部1aの電流密度に比し大幅に増加し、リベット1の下端が通電によって瞬時に高温に発熱する。そして、この発熱によりリベット1の下端が軟化し、加圧力によって図2（C）に示すようにリベット1の下端が加締められる。

40 【0012】尚、上記実施形態では、リベット1を頭付きのものとしたが、図3に示すような頭無しのピン形状のものを用いることもできる。この場合は、ワークW、Wの穴Waに図3（A）に示すようにリベット1を軽圧入で挿通して、リベット1が脱落しないようにし、次に、図3（B）に示す如く、リベット1を1対の電極4、5間に挟んで加圧した状態で通電する。この場合、リベット1の両端が夫々各電極4、5の凹入曲面4a、5aに線接触するため、リベット1の両端が瞬時に高温に発熱して軟化し、加圧力によってリベット1の両端が

50 図3（C）に示す如く加締められる。尚、この実施形態

でリベット1は中空のピン形状であるが、中実のピン形状であっても勿論良い。

【0013】厚さ2.0mmの2枚のアルミ合金板(A5182-0)を、外径8.0mm、内径4.5mm、長さ12mmの中空ピン形状のアルミ合金製(A5052)のリベットを用いてリベット締めしたところ、リベットの加締めに必要な荷重は、通電しない場合2000kgfであったが、20KA、10サイクル(1サイクル=1/50Hz)の通電で300kgfになった。

【0014】また、厚さ2.3mmの2枚のZn鋼板を、外径6.0mm、長さ12mmの鋼製(S35C)のリベットを用いてリベット締めしたところ、リベットの加締めに必要な荷重は、通電しない場合3000kgfであったが、9KA、10サイクルの通電で300kgfになった。

【0015】また、アルミ製リベットは、電気抵抗が小さいため、電流値を高くする必要があるが、熱伝導、熱

発散が良いため、鋼製リベットを用いる場合に比しワクへの熱影響が少なくなることも確認された。

【0016】尚、上記実施形態では加締め装置としてスポット溶接ガン3を用いたが、定置式のスポット溶接機を用いても良い。

【図面の簡単な説明】

【図1】 本発明によるリベット締め作業の状況を示す斜視図

【図2】 (A) (B) (C) 頭付きリベットの加締め作業の工程を示す図

【図3】 (A) (B) (C) 頭無しリベットの加締め作業の工程を示す図

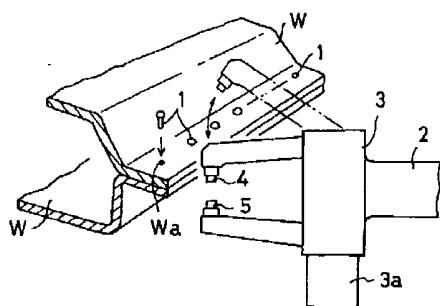
【符号の説明】

W ワーク 1 リベット

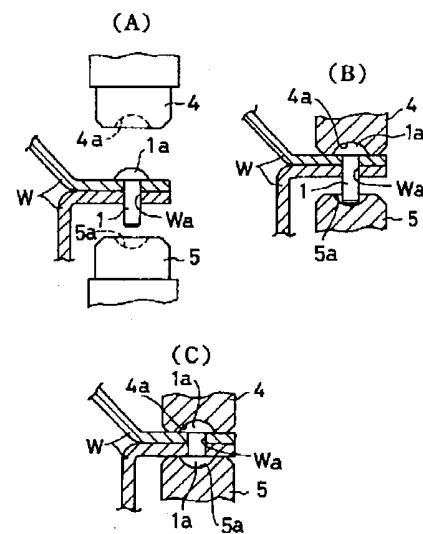
3 スポット溶接ガン 4, 5 電極

4a, 5a 凹入曲面

【図1】

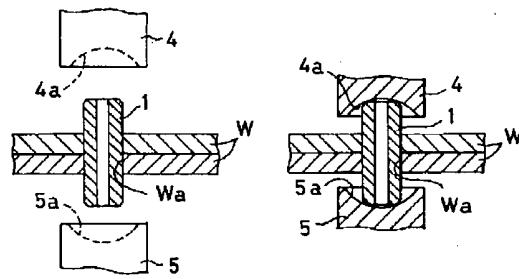


【図2】

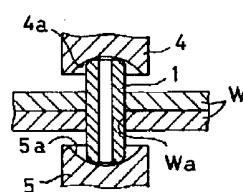


【図3】

(A)



(B)



(C)

